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MILITARY DOG TRAINING AIDS: TOXICITY AND TREATMENT

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Toxicity and Treatment

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This report is written in response to a request from the field for updated guidance on Military Dog Training Aids: Toxicity and Treatment. It includes a literature search of the substances involved in the training aids. Included are agent descriptions, chemical and physical properties, handling procedures, symptoms, toxicity to humans, toxicity to dogs, treatment and first aid.

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I. INTRODUCTION

A. PURPOSE: This report is prepared in response to a request from the 3280 TCHTG/CC to update information about military dog training aids. The specific request was for the toxicities, handling procedures, and treatments of the dogs and handlers exposed to harmful concentrations of these training aids.

B. PROBLEM: Military dog handlers and the animals being trained are required to come in contact with a variety of training aids. The agents include chemical agents and explosives. The exposure to these training aids has the potential for harm if handled improperly.

C. SCOPE: This report is designed to provide quick access to toxicities and treatment for inadvertent exposure to training compounds used in the military. The compounds and their synonyms are listed at the beginning of each section followed by a brief history and description, the symptoms, the toxicities and the treatments. The references used are supplied at the end of each section.

II. DISCUSSION

A. SMOKELESS POWDER: Also known as nitrocellulose, cellulose nitrate, nitrocotton, gun cotton, pyrocellulose.

1. Abstract

Smokeless powders, or propellants, are essentially mixtures of chemicals designed to burn under controlled conditions at the proper rate to propel a projectile from a gun. They are made in three forms (1) thin circular flakes or wafers, (2) small cylinders, or (3) small spheres. Single-based smokeless powders derive their main source of energy from nitrocellulose. The energy released from double-based smokeless powders is derived from nitrocellulose and nitroglycerin. All smokeless powders are extremely flammable. By design, they are intended to burn rapidly and vigorously when ignited (heated above 170°C by exposing powder to a flame, spark or heat from a fire).

2. Chemical and Physical Properties

Nitrocellulose

Molecular wt.	272
Color	White
Form	Cotton-like fibrous solid or amorphous powder
Density	Approx. 1.66 gm/ml

HI-SKOR (Nitrocellulose and Nitroglycerin)

Specitic gravity	1.65
Solubility in water	Negligible
Color	Black
Form	Perforated or non-perforated discs
Ignition Temp.	160-170^{o}C

3. Handling Procedures

Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Avoid breathing dust. Wash thoroughly after handling. Wash clothing after use. Avoid breathing powder fumes. Keep out of reach of children. Use only with adequate ventilation. Keep away from heat, sparks and flames. Keep container in a cool place. Keep container tightly closed. Avoid dust generation. Do not mix with acids or alkalies. Do not consume food, drink or tobacco in areas where they may become contaminated with this material. Use sparkproof tools and equipment. Wear protective gloves and glasses.

4. Symptoms

Human health effects from overexposure by inhalation, skin or eye contact, or ingestion may initially include headaches and temporary lowering of blood pressure. Higher exposures may lead to temporary nervous system depression with anesthetic effects such as dizziness, confusion, or incoordination; reduction of the blood's oxygen carrying capacity with cyanosis, weakness, or shortness of breath; and death from gross overexposure. Evidence suggests that absorption through the skin can occur in amounts capable of producing of systemic toxicity. Toxic effects described in animals from exposure by ingestion include decreased weight gain, methemoglobinemia, reproductive effects, and endocrine organ changes. Tests in some animals demonstrate carcinogenic and reproductive activity but no embryotoxic activity.

5. Toxicity To Humans

These products have not been tested for toxicity. They are class B explosives and burning, confined or unconfined, can cause physical injury, including death. The toxicity effects given below for the hazardous components may result from gross chronic or acute overexposure to the products by inhalation, eye or skin contact or ingestion.

6. Toxicity To Dogs

Oral LD_{50}: 525 mg/kg in rats is the only animal data found in our literature search.

7. Treatment

First aid treatment includes:

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen.

SKIN CONTACT: In case of contact, wash with soap and plenty of water. Burning smokeless powder may cause extensive and deep burns. Get medical attention immediately. Immerse burned areas in cold water.

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

INGESTION: If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person.

8. References (1,2,3)

B. SODIUM CHLORATE

1. Abstract

Although primarily made for use as a herbicide, sodium chlorate is a powerful oxidizer and of tremendous value in explosive manufacturing.

2. Chemical And Physical Properties

Molecular wt.	106.4
Melting Pt.	248°C
Boiling Pt.	N/A
Decomposes	265°C

3. Handling Procedures

Prevent dust accumulations. Keep material away from sparks, flames and other ignition sources. Provide emergency equipment, adequate ventilation and remove contaminated clothing immediately. Do not eat, drink or smoke in the working area. Wash out empty containers before disposal.

4. Symptoms

Sodium chlorate, when absorbed, causes the production of methemoglobin. It is a slow process and symptoms of hypoxia are delayed. Staggering, purging, evidence of abdominal pain, hematuria and hemoglobinuria may appear before hypoxia. Dyspnea, increased respiratory effort and development of cyanosis signal the hypoxic state. In acute poisoning with large amounts of chlorate, death may occur suddenly without obvious symptoms. In such cases, the history of sudden death, together with the appearance of "tarry" blood exuding from nostrils, anus and vulva, may lead to confusion with anthrax. Initially, diarrhea, nausea, vomiting and abdominal pain may occur. After several hours or longer, there is severe intestinal bleeding. Within 24 hours, kidney damage or kidney failure may occur. Liver damage, labored breathing, convulsions and coma may also develop.

5. Toxicity To Humans

The human adult lethal dose is approximately 10-30 gm. (Canadian Centre for Occupational Health and Safety)

6. Toxicity To Dogs

From the experimental evidence available, the minimum lethal dose of sodium chlorate is 700 mg/kg.

7. Treatment

Treatment of chlorate ingestion includes prompt gastric intubation, aspiration, and lavage using 3 gm sodium thiosulfate in 300 ml 5% sodium bicarbonate. Instill 30-50 gm activated charcoal in a slurry. Pain may require narcotics. Both hemodialysis and exchange transfusions have been used successfully in treating poisonings. Methylene blue is of no value in reducing the extracellular methemoglobin. Intravenous infusions of 1% sodium thiosulfate (100-500 ml) limit the concentration of circulating chlorate. Monitor serum electrolytes. Hemodialysis may be needed to sustain life in the event of extensive renal tubular necrosis.

8. References (4,5,6)

C. POTASSIUM CHLORATE

1. Abstract

Potassium chlorate, the only toxic ingredient of match heads, is a strong oxidizing agent also used in the manufacturing of dyes and explosives and as a weak antiseptic.

2. Chemical And Physical Properties

Molecular wt.	122.55 Grams/Mole
Specific gravity	2.32
Melting pt.	356^{o}C
Boiling pt.	Decompose at 400^{o}C

3. Handling Procedure

Store potassium chlorate in a cool, dry, well ventilated area. Protect containers from physical damage and sudden shocks. Use with adequate ventilation. Do not create dusty working conditions and practice good housekeeping to minimize the accumulation of potassium chlorate dust. Do not store this material on wooden floors or near organic materials. Do not smoke or eat in the work area.

4. Symptoms

In addition to local irritation of gastrointestinal mucosa, chlorates cause hemolysis, methemoglobin formation and renal failure. An initial pallor is followed by nausea, vomiting and crampy abdominal pain.

5. Toxicity To Humans

The toxic dose of potassium chlorate is frequently reported as 5 gm (more than 20 books of matches), though death has been reported in a child with as little as 1 gm. A dose of 15 to 35 gm is usually cited as the lethal adult dose.

6. Toxicity To Dogs

According to the literature review, the toxic effects in dogs have not yet been reviewed; however, we found an oral LDLo (lowest lethal dose) of 1200 mg/kg.

7. Treatment

See treatment of Sodium chlorate.

8. References (4,5,7,8)

D. C-4 (Composite C-4)

1. Abstract

Composition C-4 is a plastic demolition explosive which was used during the Vietnam War. It is considered safer for handling under battlefield conditions. The basic ingredient is RDX which was used in World War II as a high explosive and was occasionally used as a rodenticide.

2. Chemical And Physical Properties

Composition	RDX ..... 91% Polyisobutylene.... 2.1% Motor oil..... 1.6% Di-(2-ethyl-hexyl) Sebacate..... 5.3%
Density	1.59 g/cc
Color	Light brown
Odor	Odorless
Plasticity	Plastic from -57°C to 77°C
Solubility	Soluble in acetone

3. Handling Procedures

Proper ventilation is required and protective clothing and eyewear are necessary. Removal of contaminated clothing, washing of skin, and flushing of affected eyes are important.

4. Symptoms

Symptoms in poisoned animals range from twitching with mild hyperreflexia to severe convulsions. The few early signs in humans are headache, dizziness, nausea and vomiting. Some victims become unconscious and after regaining consciousness, show signs of intermittent stupor, weakness and nausea. One case had signs similar to nitroglycerin, i.e., rapid pulse, elevated systolic and depressed diastolic pressure.

5. Toxicity To Humans

There is little literature on the toxicity of C-4. Medical testing of RDX exposed workers failed to reveal any evidence of ill effects with exposures of up to 1.57 mg/m^3 (0.28 mg/m3 average). (Journal of Occupational Medicine, Vol. 19, No. 4, April 1977) The TLV (threshold limit values) established by OSHA for RDX is 1.5 mg/m^3.

6. Toxicity To Dogs

There is little data available for toxicity to dogs. Cats have been shown to have an LD_{50} of 100 mg/kg.

7. Treatment

The exposed dog should be removed from the immediate area and, if conscious, given an emetic followed by gastric lavage and a saline cathartic. Convulsions and hyperexcitability may be handled with tranquilizers or sedatives but not barbiturates. Supportive treatment includes high levels of B complex vitamins and vitamin D.

8. References (1,9,10,11)

E. DYNAMITE (AMMONIUM NITRATE BASED)

1. Abstract

The word dynamite is a general term referring to a high explosive containing as its principle ingredient either nitroglycerin or ammonium nitrate. Generally, dynamite has three ingredients consisting of: the explosive compound, a dope to absorb the explosive, and an antacid to neutralize any acid present. The strength of the dynamite is controlled by varying the content of the explosive element.

2. Chemical And Physical Properties

Composition	Percentage
Moisture	1%
Nitroglycerin	15%
Ammonium nitrate	31%
Sodium nitrate	38%
Antacid	1%
Sulfur	4%
Carbonaceous material	9%

3. Handling Procedures

As with all explosive material, the handler should avoid direct contact with the compound. Good ventilation and closed containers are essential in keeping the risk of accidental exposure or explosion at the minimum level. Keep away from heat or flames.

4. Symptoms

Symptoms of dynamite intoxication are all secondary to the cardiovascular system: dizziness, headache, hypotension, syncope, skin flushing, convulsions, cyanosis, coma and respiratory paralysis.

5. Toxicity To Humans

Transient illness has been associated with manufacturing of these materials but fatalities have been rare. Chronic intoxication has been uncommon. The exposure limit for nitroglycerin in air is 0.05 ppm, but concentrations above 0.02 ppm may cause headache. Nitrates can interact with amines to form nitrosamines, which are carcinogenic. An example is N-nitrosodimethyl amine with an LD_{50} of 26 mg/kg. Nitrosamines occur as a result of fertilizer contamination, in industrial cutting fluids, in plastics and plasticizers, in pesticides, and in toiletries.

6. Toxicity To Dogs

No toxicity levels were found in our literature search for dynamite. No case of oral intoxication in dogs has been documented.

7. Treatment

Ingested dynamite should be removed as quickly as possible by induced emesis and gastric lavage. Mineral oil should be given to speed elimination and to coat and protect irritated mucous membranes. Methemoglobinemia should be maintained below a maximum concentration of 25% with 2% methylene blue, 1 ml per 5 pounds body weight IV, repeated as necessary. In acute cases, oxygen therapy should be considered. Supportive therapy, including high levels of broad-spectrum vitamins and a bland diet, should be given. Patients should be observed closely for at least 10 days in order to detect delayed effects.

8. References (1,7,10,12)

F. DYNAMITE (NITROGLYCERIN BASED)

1. Abstract: Also known as straight dynamite.

2. Chemical And Physical Properties

Moisture	1%
Nitroglycerin	40%
Sodium nitrate	44%
Antacid	1%
Carbonaceous material	14%

3. Handling Procedures

Handlers should use the same precautions as with the other explosives. Keep away from heat or flame and in a well ventilated area.

4. Symptoms

Acute poisoning symptoms are nausea, vomiting, abdominal cramps, headache, mental confusion, delirium, bradypnea, bradycardia, paralysis, convulsions, methemoglobinemia and cyanosis, circulatory collapse, and death.

5. Toxicity To Humans

Toxic effects occur by inhalation, ingestion or absorption through the skin. A recorded fatal dose of nitroglycerin is 2 gm. The exposure limit in air is 0.05 ppm, but concentrations above 0.02 ppm may cause headaches. The TLV for nitroglycerin is 0.02 ppm (0.2 mg/m^3); the STEL (short term exposure level) 0.04 ppm (0.4 mg/m^3).

6. Toxicity To Dogs

No data were found in the literature search.

7. Treatment

In acute poisoning, establish airway and remove ingested material with emetics followed by activated charcoal. Gastric lavage may be helpful. Maintain blood pressure with fluid administration and remove any of the toxic material from skin or hair. Treat methemoglobinemia over 30% with methylene blue, 1% solution, 0.1 ml/kg IV in a 10 min. period. Give oxygen by mask if signs of dyspnea appear.

8. References (1,12,13)

G. WATER GEL (TOVEX^{tm})

1. Abstract

Water gel and slurry explosives were developed to capitalize on the low cost of ammonium nitrate while increasing the energy beyond that released by ANFOs (ammonium nitrate-fuel oil composition). They also eliminate the problem associated with the use of ANFOs under wet conditions. They increase the field safety and economy and improve fume characteristics. Water gel is a thickened suspension of oxidizers, fuels and a sensitizer dispersed in a saturated aqueous salt solution. Slurry explosives are made water resistant by the addition of hydrophilic colloids that bond the solid particles and prevent diffusion of water in and out of the system. Antifreezes, such as methanol, glycerol, and diethylene glycol, may be used.

2. Chemical And Physical Properties

Most slurry blasting agents or explosives may contain ammonium nitrate (30-70%), sodium nitrate (10-15%), calcium nitrate (15-20%), aliphatic amine nitrates (to 40%), aluminum (15-25%), TNT or other explosive sensitizer (5-20%), gellants (1-2%), stabilizers (0.1-2%), ethylene glycol (3-15%), and water (10-20%).

The specific properties of Tovex are:

Composition	Ammonium Nitrate Solution (MAX)	44.0%
	Ethylene Glycol..... (MAX)	2.0%
Other Components	Monoethylamine Nitrate	
	Calcium Nitrate	
	Sodium Nitrate	
	Aluminum Powder	
	Silica	

Specific Gravity	0.8-1.4
Form	Rubber-like gel
Package	Plastic tubes
Color	White to gray
Instability	Unstable with heat or shock
Incompatibility	Acids, alkalies, oxidants
Decomposition	Decomposes with heat and shock. Reacts with acids, alkalies, and oxidants. Hazardous gases produced are nitrogen oxides, silica and alumina fumes.
Polymerization	Polymerization will not occur.
Fire/explosion	Will detonate if suitably primed, with severe impa t, or by heat or flame. Hazardous gases produced.
Extinguishing media	None
Fire fighting	Do not fight fire. Keep personnel removed and upwind of fire. Isolate area. Evacuate personnel to safe area.

3. Handling Procedures

As with all explosives, handlers should be very careful to keep the compound in a safe dry place away from heat or flame. Store in accordance with Federal regulations. Do not store or consume food, drink, or tobacco in areas where they may become contaminated with this material. Store in an approved magazine.

4. Symptoms

Overexposure to the product by inhalation, eye or skin contact, or ingestion may cause the health effects described below for components. This product is a mixture and has not been tested for toxicity.

Ammonium nitrate:

A skin and eye irritant. Toxic effects in animals from acute exposure by ingestion include neurological effects and nonspecific effects such as weight loss and irritation. Human health effects from overexposure by skin or eye contact or ingestion may initially include skin irritation with discomfort or rash and eye irritation with tearing or blurring of vision.

Monoethylamine nitrate:

A skin and eye irritant. Effects described in animals from exposure by inhalation, ingestion, or skin contact include methemoglobinemia, liver effects, and nonspecific effects such as weight loss and irritation. Human health effects from overexposure may initially include skin irritation with discomfort or rash and eye irritation with discomfort, tearing or blurring of vision.

Calcium nitrate:

Reported human health effects from overexposure include irritation and cauterizing action of the skin and mucous membranes, gastric irritation and cyanosis.

Sodium nitrate:

In animal tests sodium nitrate produced eye irritation. It has shown reproductive effects. Symptoms from ingestion include abdominal pain, diarrhea, muscular weakness, convulsions, cyanosis and death. Reported human health effects include nausea, vomiting, cramps, headache and convulsions.

Aluminum powder:

Toxic effects described in animals from short exposures to aluminum powder by inhalation include pulmonary effects. Human health effects by inhalation, ingestion, or skin or eye contact may initially include temporary lung irritation with cough, discomfort, difficult breathing or shortness of breath. Chronic and excessive exposures may lead to chronic lung disorders with symptoms of lung insufficiency.

Ethylene glycol:

In animal tests ethylene glycol is an eye irritant. Toxic effects in animals by inhalation, eye or skin contact or ingestion include kidney and liver effects. Reported human health effects include nausea, headache, weakness, loss of kidney function, edema, uremia, temporary nervous system depression and anaesthetic effects.

Silica:

Overexposure to certain forms of silica by inhalation causes silicosis and associated respiratory problems.

5. TOXICITY:

Toxicity is categorized by component and may not be specific for either dogs or humans. Available information on toxicity studies is listed.

Ammonium nitrate: .....Oral LD_{50} 3,732 mg/kg in rats.

Monoethylamine nitrate: Skin absorption LD_{50}> 11,000 mg/kg in rabbits.

Calcium nitrate:.....Not available.

Sodium nitrate:.....Oral LD_{50}=3,000 mg/kg in rats.

Aluminum powder:.....Not available.

Ethylene glycol:.....Toxic dose varies in dogs (4.2-6.6 ml/kg).

Silica:.....Not available.

6. Treatment/First Aid

Flush skin with water for skin contact. In case of eye contact, immediately flush eyes with copious quantities of water for at least 15 minutes. Call a physician. If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Seek immediate medical assistance.

7. References (12,14,15)

H. TNT: Also known as trinitrotoluene, tolite, trilite, tritol, triton, trotyl.

1. Abstract

TNT is used alone as a bursting-charge explosive for shells, bombs, and grenades and as an ingredient of binary explosives and commercial explosives such as dynamite. It can be used in the dry form or mixed with flexible binders to form "plastic" explosives.

2. Chemical And Physical Properties

Chemical name	2,4,6-trinitrotoluene
Formula	$CH_3C_6H_2(NO_2)_3$
Molecular wt.	227.13
Vapor pressure	0.042 mm Hg at 80°C 0.067 mm Hg at 90°C 0.106 mm Hg at 100°C
Boiling pt.	240°C
Freezing pt.	80.75°C
Specific gravity	1.654

Flash pt.	Explodes at 240°C
Solubility	Water (0.02 gm/100 ml at 15°C) Alcohol (1.99 gm/100 ml at 32°C) Ether (3.33 gm/100 ml at 20°C) Chloroform (25 gm/100 ml at 18°C) Carbon tet (1.5 gm/100 ml at 18 C) Benzene, toluene, acetone soluble

3. Handling Procedures

Good housekeeping and adequate ventilation should be provided to maintain the atmospheric concentration of TNT dust at below recommended acceptable levels. Workers should be supplied with protective clothing that is laundered at regular intervals. Adequate washing facilities should be available and a high standard of personal hygiene encouraged. The substance may gain entry to the body by skin absorption, inhalation or ingestion.

4. Symptoms

Trinitrotoluene exerts a toxic effect similar to that of other nitro compounds, and exposure to this substance may cause irritation of the digestive tract, methaemoglobinemia (and the consequent effects of oxygen deficiency), toxic jaundice, aplastic anemia and cataracts. A common sign if absorbed is orange staining of the hands, arms and face. Dermatitis is relatively uncommon, although TNT has been known to cause papular eruption on exposed skin, with edema and subsequent desquamation. Gastritis may occur with nausea, vomiting and epigastric pain not related to meals. Typical toxic jaundice is a symptom of severe intoxication with poor prognosis; there is yellow coloration of the skin and conjunctiva with enlargement of the liver and dark urine.

5. Toxicity To Humans

In moderate exposures (air concentrations of 0.8 mg/m^3), increased levels of serum glutamic oxalacetic transaminase and lactic dehydrogenase have been observed. At air concentrations of 0.6 mg/m^3 such changes persisted. Aplastic anemia is the most severe outcome of TNT poisoning (it has occurred at exposure levels ranging from 1 to 3.5-7.0 and 10.7 mg/m^3; however, in the majority of these cases skin contact had also taken place). The anemia is severe, profound and normocytic, and prognosis is poor. Exposures below 0.5 mg/m^3 produce no apparent ill health. The toxic level of toluene in humans is 0.5 to 1 gm/kg.

6. Toxicity To Dogs

In experimental animals, the toxicity of toluene ranges from 2 to 5 gm/kg. In large amounts, it depresses the central nervous system and in repeated exposure to small amounts, toluene depresses the bone marrow.

7. Treatment

Remove ingested material by gastric lavage and provide artificial respiration as needed. Control convulsions with diazepam, 0.1 mg/kg IV. Do not give epinephrine, ephedrine or related drugs because they may induce fatal ventricular fibrillation.

8. References (1,12,13,16)

I. DETONATION CORD: Also known as PETN, Symtex-H, T4, cyclonite, PE4 and RDX).

1. Abstract

RDX (cyclomethylenetrinitramine, cyclonite, hexogen, T4) was first prepared in 1899 but it was not until 1920 that von Hertz discovered its value as a high explosive. RDX can be totally synthesized using only coal, water, air and electrical energy. However, the most efficient production process is by the nitration of hexamethylene-tetramine in the presence of ammonium nitrate and acetic anhydride.

2. Chemical And Physical Properties

Chemical name	Cyclotrimethylene trinitramine
Formula	$C_3H_6N_6O_6$
Molecular wt.	222
Color	White
Specific gravity	1.816
Hardness (Mohs scale)	2-3
Melting pt.	204.1°C
Heat of combustion	2285 cal/gm
Specific heat (20°C)	0.30 cal/gm °C
Solubility	Insoluble in water, slightly soluble in ethyl alcohol, ether, benzene, toluene, chloroform, carbon tetrachloride, carbon disulfide and the esters of glycols. Readily soluble in hot aniline, phenol and warm concentrated nitric acid.

3. Handling Procedures

Provide adequate ventilation and dust free area. Have proper personal protection devices. Keep containers carefully stored and away from heat and flame.

4. Symptoms

Symptoms include salivation, dizziness, nausea, vomiting, ataxia, convulsions, coma, and death.

5. Toxicity To Humans

The minimum lethal dose as determined in rats by single oral doses of a 4% solution was about 200 mg/kg. The TLV for RDX is 1.5 mg/m^3.

6. Toxicity To Dogs

There were no data found that stated the toxic levels in dogs but signs of intoxication were evident at a level of 50 mg.

7. Treatment

Treatment of ingestion of cyclonite is diazepam or barbiturates to control the convulsions. First aid is to give an emetic and gastric lavage. To reduce the dose of barbiturate, use acepromazine IV. The dose of diazepam is 5-15 mg TID IV. Fluids and supportive therapy are recommended.

8. References (10,12,17,18)

J. MARIJUANA/HASHISH

1. Abstract

Cannabis sativa, or marijuana, is not a single uniform plant like many of those encountered in nature, but a rather deceptive weed with several hundred variants. In the two distinct groups, the drug type and the fiber type, there are three chemical types; the pure type, high THC (tetrahydrocannabinol) content (2-6%) and lacking CBD (cannabodiol), the "intermediate type" (predominantly THC), and the fiber type (THC <0.25%). Hashish is the purified alcoholic extract of Cannabis sativa.

2. Chemical And Physical Properties

The highest concentration of major cannabinoids (THC, CBD) occurs in the top leaves of the plant which contain bracts. No cannabinoids have ever been found in seeds, roots, or stalks. Sixty-one other cannabinoids have been isolated, as well as 360 other compounds: alkaloids (traces), sterols, terpenes, flavonoids, furan derivatives, and cannabigerol-like substances derived from stilbene.

3. Handling Procedures

As with all drugs, keep away from pets and children. Keep in sealed, safe containers.

4. Symptoms

Humans: A one gram marijuana cigarette prepared from drug-type plants contains 34 to 48 mg of delta-9-THC. This amount has produced transient hallucinations and other psychotomimetic symptoms in a healthy person who had not been previously exposed to the drug. Other symptoms include dry mouth, dizziness, tachycardia, blurred vision, memory lapse, tingling, anxiety, confusion, drowsiness, nausea and headache.

Dogs: There have been many descriptions of the effects of cannibis in dogs and of the ataxia assay derived from the earlier studies. Initially, there may be some excitement and barking. Retching, vomiting, salivation; urination or defecation may occur. Mydriasis may also occur. Then follows the state of ataxia, swaying of the head and body, twitching of the muscles, awkward gait and slipping of the feet, reduced activity with a tendency to stand in one spot, head sinking lower and lower then jerked back up. Very characteristic is useless scratching. They may sleep for up to 24 hours. Toxic signs preceding death are ataxia, hyperexcitability, depression, loss of righting reflex, and dyspnea progressing to respiratory arrest.

5. Toxicity To Humans

In man, there have been very few reported cases of fatalities due to ingestion of large amounts of cannibis. In the search there was only a single source giving the lethal IV dose of delta-9-THC in a 70 kg man. It is in the order of 5,000 mg or 70 mg/kg (LD_{12}). The oral lethal dose is estimated at 10 to 20 times higher.

6. Toxicity To Dogs

In dogs, only one report of acute toxicity levels was found and it was oral dose <930 mg/kg.; IV dose of 223 mg/kg. More current literature may provide additional toxicity information.

7. Treatment

Humans: Treatment of the rare case of acute overdose or toxic psychosis from marijuana should be supportive and include monitoring respiration, blood pressure, and heart rate. The patient should be kept in a quiet area and reassured that the drug will have no permanent effects and the experience will wear off after several hours. Those who are extremely agitated may require 5 to 10 mg doses of diazepam (Valium) administered orally. A patient with a classic toxic psychosis

will be disoriented and hallucinating. Supportive treatment is indicated. The use of phenothiazines, which have a hypotensive effect additive to that of THC, should be avoided. Patients with postural hypotension should be placed in "Trendelenburg" position, and fluids should be administered if necessary.

Dogs: Similar treatment regimen followed in dogs as in humans; keep in a quiet area, monitor vital signs and treat with diazepam as needed. The dose of diazepam is 5 to 10 mg.

8. References (4,7,12,16,19,20)

K. HEROIN

1. Abstract

Heroin is cited as the most common street form of abused opiate. Another name for heroin is diacetylmorphine. There are more than fifteen street names for heroin, including "Snow, Junk, Horse, Smack and Mexican Brown". "China white" is a recently introduced substitute for heroin and is fentanyl or one of it derivatives.

2. Chemical And Physical Properties

Molecular wt.	369.42
Boiling pt.	272^{o}C
Melting pt.	173^{o}C
Density	1.56-1.61
Solubility	Benzene and chloroform

3. Handling Procedures

As with all illegal drugs, keep in secure containers and away from pets and children.

4. Symptoms

Clinical toxic symptoms of heroin are pinpoint pupils, bradycardia, hypotension, hypothermia, respiratory depression, coma and pulmonary edema.

5. Toxicity To Humans

Studies of toxic doses in humans have not been performed, but a fatal dose of 0.2 gm has been documented.

6. Toxicity To Dogs

No data were found in the literature search for toxicity of heroin in dogs.

7. Treatment

Maintain respiration. If patient is conscious, give gastric lavage or emetic. Treat with antidote, Narcan at 0.01 mg/kg IV, in massive overdose of heroin use up to 0.2 mg/kg.

8. References (4,7,12,20)

L. COCAINE

1. Abstract

The effects of cocaine are similar to those of intravenous amphetamine except the duration of action is shorter and onset of the effect is quicker. Cocaine is used in medicine as a local anesthetic on mucous membranes. In such use, the fatal dose may be as low as 30 mg. Ingested cocaine is less toxic than that taken by other routes. The manifestations of cocaine poisoning are convulsions and circulatory collapse.

2. Chemical And Physical Properties

Cocaine hydrochloride

Molecular wt.	339.81
Melting pt.	195°C
Solubility	1 gm dissolves in 0.4 ml of water, 2 ml of hot alcohol, and 12.5 ml of chloroform

3. Handling Procedures

As with any illegal drug, keep in secure place and prevent dogs (as well as children) from ingesting the material.

4. Symptoms

After high doses, cocaine produces euphoria and hallucinations. Other signs are restlessness, dilated pupils, hyperreflexia, tachycardia, nausea, vomiting, and muscle spasms. Large doses may cause cardiac arrhythmias and other cardiovascular complications as well as respiratory effects. The patient may be hyperreflexic, quite anxious, disoriented, and appear paranoid. In acute intoxication, hyperventilation precedes a later respiratory depression. Sweating, headache, mental confusion, dry throat, and dizziness are common. In severe cases, clonic-tonic convulsions, cardiovascular and respiratory collapse can take place.

5. Toxicity To Humans

The fatal dose may be as low as 30 mg. Death may occur immediately or up to 3 hours later. In the medical field, it is suggested to use no more than 50 mg (1 ml of a 5% solution) on mucous membranes, in adults. In patients under 20, less should be used. Adulteration of "street" cocaine is common due to the cost of the drug. It is often mixed with benzocaine, lidocaine, procaine, and tetracaine; therefore, toxic levels may vary.

6. Toxicity To Dogs

In a study conducted by Catravas et al. (1981) the average lethal dose in normal dogs was found to be 21 mg/kg (approx. 525 mg for a 55 lb. dog). The published data of cocaine toxicity in dogs was limited but the LD_{50} was found to be 13 mg/kg by intravenous administration. The subcutaneous LDLo was 3500 ug/kg.

7. Treatment

Treatment of acute cocaine intoxication is to provide adequate supportive car . In fully conscious people, remove as much of the drug as possible by emesis. Narcan is the antagonist drug of choice. A sedative drug such as diazepam (Valium) can be administered for severe toxic psychosis. In dogs an important consideration is to prevent hyperthermia. The most common method is usually a cold water bath. The drug of choice is Naloxone (Narcan) at 0.04 mg/kg IV, IM, SC. If an effective increase in respiration is not achieved with the first dose, repeat every 2-3 min. until respiration returns to normal and the patient responds to stimuli.

8. References (7,12,20,21)

M. MACE (Chloroacetophenone, CN)

1. Abstract

Mace is a general term referring to any of a number of lacrimators (tear agents) containing chloroacetopenone (CN) alone or in one of a variety of carrier solvents. Aerosol sprays of these agents cause an immediate intense irritation of the eyes and a profuse flow of tears. Tear gas guns contain 2-chloroacetophenone in a divided state with an explosive device to propel the charge several feet. Most liquid riot agents contain 2-chloroacetophene (1%) and one or more of a variety of solvents such as 1,1,1-trichloroethane (5%), kerosene-like hydrocarbons (5%), or propylene glycol (50-90%). The propellant is usually trichlorofluromethane. Other riot control agents may contain chloropicrin, bromobenzyl cyanide, and 0-chlorobenzylmalononitrile.

2. Chemical And Physical Properties

Chemical name	Chloroacetophenone
Formula	$C_6H_5COCH_2CL$
Molecular wt.	154.59
Vapor density	5.3
Liquid density	1.26 at 55°C
Solid density	1.32 at 15°C
Boiling pt.	244°C to 245°C
Vapor pressure	0.0017 mm Hg at 0°C; 0.0054 mm Hg at 20°C; 0.158mm Hg at 55°C
Volatility	30 mg/m^3 at 0°C; 105 mg/m^3 at 20°C
Flash pt.	High enough not to interfere with the military use of the agent
Decomposition temp.	Stable to boiling
Latent heat of vap.	98 calories/gm as with vomiting agents, CN must be vaporized or dispersed by some other means than by its own volatility.
Rate of hydrolysis	Not readily hydrolyzed
Hydrolysis products	Hydrogen chloride and hydroxymethyl-atphenylketone
Stability in storage	Stable
Action on metals	Tarnishes steel
Odor	Fragrant, similar to apple blossoms
Median lethal dose	11,000 $mg/min/m^3$
Median incapacitating dose	Approx. 80 $mg/min/m^3$
Rate of detox.	Rapid; effects disappear in a few hours

3. Handling Procedures

Handlers should be aware of the potential hazard from skin and eye exposure and ingestion. Protective clothing, gloves and face masks offer additional protection. Contaminated clothing should be washed. Exposed personnel should immediately shower to avoid excessive skin contact.

4. Symptoms

Exposure to mace causes eye irritation and tearing. It also causes coughing, nausea, vomiting and severe skin irritation.

5. Toxicity To Humans

The current PEL is 0.1 ppm averaged over an 8-hour work shift. A concentration of 15 ppm cannot be tolerated longer than 1 min, exposure to 4 ppm for a few seconds is temporarily disabling, due to irritant effects. Concentrations of 0.3 to 0.37 ppm causes painful eye irritation in 3 to 30 seconds. Mace has an odor threshold of 1.1 ppm. Death results from pulmonary edema. The STEL (short term exposure limit) for riot control agents is as follows: 2-chloroacetophene, 0.05 ppm; o-chlorobenzylidene malononitrile, 0.05 ppm; and chloropecrin, 0.1 ppm. The maximum safe inhaled dose of CN for man over short periods of time is 500 $mg/min/m^3$.

6. Toxicity To Dogs

The literature search found little data on dog toxicity. The following data were found for oral LD_{50} doses.

Rat	127 mg/kg
Rabbit	118 mg/kg
Guinea pig	158 mg/kg

7. Treatment

For CN toxicity, emergency first aid treatment should be started including washing of the eyes and skin with large amounts of water. Move the victim to fresh air and if any mace has been swallowed, consuming large amounts of water followed by vomiting is advised. Treatment of the dog by the veterinarian will depend on the severity of the exposure. If it was from the discharge of a weapon, the eyes must be carefully inspected for solid particles of unvaporized agent and other foreign bodies including particles of propellant, wadding, etc. Severe blepharospasm and/or the disposition of the animal may dictate deep sedation or general anesthesia to help remove the foreign matter followed by a thorough flushing of the eyes and conjunctiva with a 0.4% sodium sulfite solution. The animal should then be bathed with a mild detergent or shampoo to completely remove all CN from the hair and skin. Treatment with mydriatics (atropine) should be

initiated to prevent iridocyclitis. Cortisone therapy is advisable if not contra-indicated by erosions or abrasions of corneal epithelium. General antibiotic therapy should be administered for the first several days with corticosteroid therapy started at the first sign of iridocyclitis. Topical treatment with antibiotic ophthalmic drops or ointment should be administered several times a day until all symptoms have disappeared. Animals exposed to high concentrations should be observed for signs of pulmonary edema and started on antibiotics and oxygen therapy as indicated.

8. References (1,12,20,22,23)

N. CYANIDE - Also known as hydrogen cyanide, sodium cyanide, potassium cyanide, calcium cyanide, calcium cyanamide, cyanogen chloride, cyanogen bromide, dimethyl cyanamide, hydrocyanic acid, prussic acid or formonitrile.

1. Abstract

Cyanides are produced in large quantities and are very toxic industrial chemicals. Nitriles are compounds that dissociate to produce cyanide. We could devote a great deal of time to nitriles but this study is limited to the discussion of hydrogen cyanide.

2. Chemical And Physical Properties

Physical state	Colorless liquid with characteristic odor of bitter almonds
Molecular weight	27.03
Melting point	$-13.2^{o}C$
Boiling point	25.7oC
Refractory index	1.2619($20^{o}C$)
Vapor density	0.94(air=1)
Vapor pressure	807.23 mmHg ($27.22^{o}C$)
Percent in saturated air	100 ($25.7^{o}C$)
Solubility	Soluble in alcohol, ether and miscible in water
Flash point	$-17.8^{o}C$ (closed cup)
1 mg/m^3=	0.9 ppm at $25^{o}C$, 760 mmHg

3. Handling Procedures

Handlers of cyanide should take proper precautions including work garments covering the arms, legs and body; gloves, boots and shoes of impervious material; eye and face protection. It is important to remove and change if clothing becomes wet. Areas should be adequately ventilated. Recommended standards are found in NIOSH STD 77-108.

4. Symptoms

Humans may show signs of weakness, headache, confusion and occasionally nausea and vomiting. Pulse rate increases and respiration increases at first, then slows. Ingestion of amounts as low a 50 to 100 mg may be followed by almost instant collapse and cessation of breathing. Heartbeat may continue after respiration has ceased. Chronic exposure can lead to thyroid enlargement. Dogs show signs of ataxia and nausea but usually become comatose rapidly and can smell of bitter almonds.

5. Toxicity To Humans

The current permissible exposure limit (PEL) for humans is 10 ppm (11 mg/m^3) as a time weighted average. The concentration "immediately dangerous to life or health" (IDLH), the level from which one could die within 30 minutes is 50 ppm. (NIOSH/OSHA #78-210)

6. Toxicity To Dogs

The literature reported the PEL as 0.035 mg/l (30 ppm).

7. Treatment

Humans: Antidotes are administered with the combined use of artificial respiration (mouth to mouth resuscitation is inadvisable) and the simultaneous inhalation of amyl nitrate vapor from ampules crushed in a handkerchief and held close to the nose of the victim. Several ampules may be used in the first half hour. This alone may suffice for treatment of milder cases, provided the sources of absorption are removed. In more serious cases, give 0.3 gm sodium nitrite (10 ml of a 3% solution at a rate of 2.5 to 5 ml/min) followed immediately by 12.5 gm of sodium thiosulfate IV (50 ml of a 25% solution at the rate of 2.5 to 5 ml/min). Repeat the sodium nitrite and thiosulfate therapy in one hour at half the original dose if symptoms recur or persist.

Dogs: Administer oxygen therapy under positive pressure. By mouth, give activated charcoal, and hydrogen peroxide, 1 part, to sodium thiosulfate (5%) 5 parts. Administer an IV solution of 1% sodium nitrite, at the dosage of 16 mg/kg. Follow with 20% solution of sodium thiosulfate at a dosage of 30 to 40 mg/kg IV. If treatment is repeated, use only sodium thiosulfate.

NOTE: The above may be given simultaneously as follows: 0.5 ml/kg of combination consisting of 10 gm sodium nitrite, 15 gm sodium thiosulfate, distilled water qs 250 ml. Dosage may be repeated once. If further treatment is required, give only 20% solution of sodium thiosulfate at level of 1 mg/kg.

8. References (7,10,16,20)

O. PARAQUAT

1. Abstract

Paraquat can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. It may enter the body through the skin. It causes lung, liver, eyes, heart and kidney damage as well as skin irritation.

2. Chemical and Physical Properties

Molecular wt.	257.2
Boiling pt.	760 mmHg
Specific gravity	Not available
Vapor density	Not applicable
Melting pt.	Data not available
Vapor pressure	20°C (68°F)
Solubility in water (g/100 g water at 20°C)	Very soluble

3. Handling Procedures

Handlers should be provided with impervious clothing, gloves, face shields (8-inch minimum) and other appropriate gear if exposure is anticipated. Contaminated clothing should be removed and washed. Eating and smoking should not be permitted in the areas where paraquat is handled, processed or stored.

4. Symptoms

Paraquat is a respiratory irritant and can cause severe lung damage. It may cause irritation to the eyes, nose, throat and skin. Nose bleeding and loss of fingernails may also be seen. Exposure to mixtures of paraquat and a related compound, diquat, may cause serious and permanent injury to the eyes. Swallowing paraquat may cause burning in the mouth and throat, nausea, vomiting, abdominal pain, diarrhea, heart, lung, kidney and liver damage with yellow jaundice.

5. Toxicity to humans

The current PEL for paraquat is 0.5 mg per cubic meter of air averaged over an eight-hour work shift. The American Conference of Governmental Industrial Hygienists has recommended for paraquat a Threshold Limit Value of 0.1 mg per cubic meter.

6. Toxicity to dogs

Not found in the literature search.

7. Treatment

Humans exposed to paraquat should immediately flush the contaminated skin or eyes with water. Move victim to fresh air and if breathing has stopped, perform artificial respiration. If the solution has been swallowed and the person is conscious, give large quantities of water and follow with induced vomiting. Do not make an unconscious person vomit. After evacuating the stomach, load the gastrointestinal tract with an effective adsorbent to minimize toxin absorption. Intubate the stomach after inducing vomiting and lavage with at least 2 liters of a slurry of adsorbent in normal saline. The ideal adsorbent is Bentonite, administered as a 7.0 gm per 100 ml suspension. If not available, use activated charcoal 30-50 gm in 300-400 ml of water. Start saline catharsis by giving sodium sulfate, 0.25 gm/kg and repeat in two hours if no bowel movement has occurred. Do not use magnesium salts because they are contraindicated in impaired renal function. Continue with the bentonite suspension and sodium sulfate until the gut has been thoroughly flushed. This may take several days. Intravenous infusions of electrolytes and glucose should be started to minimize toxicant concentrations in the tissues, and help expedite excretion of the toxin. Recommend diuresis of 10-15 liters per day. Fluid balance should be monitored to prevent acute tubular necrosis.

8. References (12,24,25,27)

P. AMPHETAMINES AND METHAMPHETAMINES

1. Abstract

Amphetamines are widely abused because of their stimulating effects on the central nervous system. Another pattern of abuse, usually with methamphetamine, is "speed-balling" in which it is injected together with heroin.

2. Chemical and Physical Properties

Molecular wt.	135.21
Boiling pt.	203-4^{o}C
Solubility	Soluble in alcohol and ethanol

3. Handling Procedures

As with all drugs, keep away from pets and children. Keep in tightly sealed containers.

4. Symptoms

The symptoms of acute amphetamine intoxication include dilated pupils, dry mouth, sweating, increased blood pressure, hyperactive tendon reflexes, fever, and in severe cases, confusion, paranoid ideation and aggressive behavior. In severe cases of ingestion by non-tolerant humans, symptoms include severe agitation, sleeplessness, hallucinations, tachycardia, arrhythymias, severe hypertension, cardiovascular collapse, cerebrovascular accidents and even death. In dogs, signs are delirium, hyperpyrexia, bounding pulse, and dialated pupils. In severe cases, convulsions, circulatory collapse, coma followed by death are the signs.

5. Toxicity to Humans

Doses of 100 mg have been shown to be the MLD in humans.

6. Toxicity to Dogs

The LD_{50} is estimated to be 4 to 10 mg/lb orally.

7. Treatment

In humans treatment of acute amphetamine intoxication is primarily the support of vital functions. The patient should be kept quiet. Chlorpromazine (Thorazine) should not be used to treat mental or psychotic disturbances in people resulting from intoxication. Diazepam (Valium) may be given orally or intravenously to produce sedation. Haloperidol (Haldol) may be used if acute amphetamine psychosis is present. Propranolol (small doses) may be helpful to treat excess peripheral adrenergic effects.

In dogs Chlorpromazine has been recommended at 1 mg/kg IM, IP, IV; administered at only half dose if barbiturates have been given. This dose blocks excitation. Lavage the stomach and leave activated charcoal slurry in. One hour later give saline laxative. Diazepam (Valium) is given to control convulsions at 2-5 mg/kg.

8. References (7,12,16,20)

Q. ROUNDUP (Glyphosate)

1. Abstract

Roundup is used as a herbicide for control of rasses, broad leaved weeds and woody brush.(U.S. EPA, 1986)

2. Chemical and Physical Properties

Chemical formula	$C_3H_8NO_5P$
Molecular wt.	169.07
Physical state (25°C)	White crystalline solid
Boiling pt.	--
Melting pt.	200°C
Density	1.74
Vapor Pressure	--
Water Solubility	10 gm/L
Appearance	Colorless solution
Odor	Essentially odorless
Specific Gravity	1.22-1.25

3. Handling Procedures

Avoid contact with eyes, skin or clothing. Avoid contamination of seed, feed and foodstuffs.

4. Symptoms

Repeated dermal contact with glyphosate at concentrations 1 and 5 times the intended use produced slight skin irritation in rabbits. No other adverse effects were observed.

5. Toxicity To Humans

The LD_{50} in humans was found to be 4300 mg/kg. Using a no observed adverse effect level of 175 mg/kg/day, the 10 day health advisory for a 10 kg child is 17.50 mg/L.

6. Toxicity To Dogs

No toxicity reports for dogs were found but an oral LD_{50} in rats was found to be 5,600 mg/kg. (Monsanto Company, 1982)

7. Treatment

First Aid: For exposure to eyes, flush with plenty of water for at least 15 minutes. For exposure to skin, flush with water, wash clothing with soap and water before reuse.

8. References (12,24,25,26)

Treatment Summary Table

COMPOUND	SYMPYOMS	FIRST AID	ANTIDOTE
Smokeless powder	Dizziness, weakness, cyanosis.	Flush eyes and skin with water, gastric lavage, emetics.	N.A.
Sodium chlorate/ Potassium chlorate	Diarrhea, nausea, vomiting, dyspnea, cyanosis.	Promote gastric lavage 3g sodiumthio-sulfate in 300mL 5% sodium carbonate. Install 30-50gm activated charcoal in a slurry.	Narcotics for pain. Sodiumthiosulfate 1% (100-500 ml) IV.
C-4	Nausea, vomiting, twitching, stupor.	If conscious, give emetic and gastric lavage and saline cathartic.	Treat convulsions with tranquilizers or sedatives but not barbiturates. Supportive treatment with B-complex and vitamin D.
Dynamite ammonium nitrate base	Hypotension, syncope, skin flushing, convulsions, cyanosis, dizziness, headache, coma, respiratiry paralysis.	Induce emesis, gastric lavage, mineral oil.	Adrenalin, ergotamine tartrate, 2% methylene blue 1 ml/5lbs. IV. Repeat as necessary. B vitamins and Bland diet for 10 days.
Dynamite nitroglycerin base	Nausea, vomiting, paralysis, abdominal cramps, headache, delirium, bradycardia, convulsions.	Establish airway, emetics, gastric lavage.	IV fluids 1% methylene blue 0.1ml/kg IV for 10 min. Oxygen if dyspneic.
Tovex^{tm}	Reference the text		
TNT Trinitrotoluene	Nausea, vomiting, toxic jaundice, orange stained skin, convulsions.	Artificial respiration, gastric lavage, keep quiet.	Control convulsions with diazepam, 1.0 mg/kg IV. DO NOT give epirephrine or ephedrine.

Treatment Summary Table

COMPOUND	SYMPTOMS	FIRST AID	ANTIDOTE
Detonation cord	Epileptiform convulsions, vomiting, weakness, unsteady, restlessness.	If conscious give emetic and gastric lavage. Keep in quiet cool place.	Diazepam TID 5–15 mg IV or barbiturates Acepromazine 2 mg IV followed by sodium pentobarbital drip, glucose, B complex and vitamin C.
Marajuana, hashish	Dry mouth, dizziness, tachycardia, blurred vision, anxiety, confusion, drowsiness, nausea, headache, ataxia, scratching, sleepy, severe signs of dyspnea, respiratory arrest.	Prompt emesis, keep in quiet, cool place.	Diazepam 5–10 mg doses. DO NOT use phenothiazines. I.V. fluids as needed.
Heroin	Pinpoint pupils, bradycardia, hypotension, hypothermia, respiratory depression, coma, pulmonary edema.	Maintain respiration, emetic and gastric lavage.	Narcan at 0.01 - 0.2 mg/kg IV.
Cocaine	Restlessness, dialated pupils, hallucinations, hyperreflexia, tachycardia, nausea, vomiting, muscle spasms, convulsions in severe cases.	Emesis, prevent hyperthermia.	Narcan at 0.04 mg/kg IV, IM, SC. Repeat every 2–3 min. until respiration returns to normal.
Mace	Tearing, coughing, nausea, vomiting sneezing, itching.	Wash eyes check for foreign bodies, flush with 4% sodium sulfite solution. Wash all exposed area of skin, hair, etc.. Drink large amounts of water, followed by emetic.	Mydriatics to prevent iridocyclitis. IV fluids, general antibiotic therapy, for Ethylene glycol toxicity use ethanol IV and 8 ml of 5% sodium bicarbonate per kg IP. Repeat every 4 hours for 5 treatments. Then, every 6 hours for 4 treatments.

Treatment Summary Table

COMPOUND	SYMPTOMS	FIRST AID	ANTIDOTE
Cyanide	Weakness, headache, confusion, nausea, vomiting, increased pulse rates then decrea[illegible] respirator arrest.	Ar[illegible]ficial respiration, amyl nit[illegible]te vapor, [illegible]c lavage, and emetics.	Sodium nitrate 1% solution IV at 16 mg/kg. Follow with 20[illegible] solution of sodium thiosulfate at 30 to 40 mg/kg IV. If repeated use only sodium thiosulfate 20 solution at 1mg/kg.
Paraquat	Irritation to eyes, nose, throat, skin,nausea, vomiting, abdominal pain, diarrhea, jaundice, death.	Flush eyes. Artificial respiration, gastric lavage, emetics. Give bentonite 7gm/100ml suspension or activated charcoal 30-50 gm in 300-400 ml water. Saline catharsis with sodium sulfate 0.25 g/kg. Repeat in 2 hours if no bowel movement.	IV electrolytes, glucose, diuresis of 10 15 L/day.
Amphetamines	Dialated pupils, dry mouth, sweating, increased blood pressure confusion, aggressive behavior, hypertension, cardiovascular collapse, convulsion, death.	Lavage stomach, leave activated charcoal in 1 hour later give saline laxative.	Chlorpromazine 1mg/kg IM, IP or IV give mg/kg if following barbiturate treatment. Diazepam at 2-5 mg/kg to control covulsions.
Roundup[tm]	Skin irritation, vomiting, convulsions, coma.	Flush eyes and skin with plenty of water and gastric lavage.	I.V. fluids.

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